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Title: Drinking to cope: A latent class analysis of coping motives for alcohol use in a large cohort of adolescents

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Abstract

Background: Alcohol consumption during adolescence is widespread, although there is considerable variation in patterns of use. The aim of this study was to identify patterns of coping-motivated alcohol use in a UK birth cohort, and examine individual and family characteristics associated with the resulting drinker profiles.

Method: At age 17, participants (*n*= 3,957; 56% female) reported their alcohol and drug use, internalising symptoms, and use of alcohol to cope with a range of emotions. Socio-demographic data were collected via maternal report. Latent class analysis identified drinker subtypes based on the coping motives reported. Association between these profiles and socio-demographic characteristics and internalising disorders was examined.

Results: The vast majority (92%) of adolescents reported alcohol consumption in the past year, and 26% of those drank weekly or more often. Four distinct motive profiles were identified. These profiles were associated with different socio-demographic characteristics: adolescents from higher socio-economic backgrounds drank primarily for increased confidence, whereas adolescents from low socio-economic backgrounds were more likely to drink to cope with low mood. Adolescents with an anxiety or depressive disorder were six times more likely to fall within the high-risk subtype, characterised by a generalised pattern of drinking to cope with emotions across the board.

Conclusions: Coping motives for drinking vary with individual and family factors. Adolescents from low versus high socio-economic backgrounds were characterized by distinct drinking profiles; thus prevention messages may need to be tailored accordingly. Internalising disorders were strongly associated with a high-risk profile of coping-motivated drinking.

Introduction

Adolescence is a critical period for the initiation of alcohol use, with 70-90% of adolescents in Europe and the USA consuming alcohol by the age of 18 (Degenhardt et al., 2008). Immediate public health harms associated with alcohol use during adolescence include increased risk of injury, antisocial behaviour, regretted and risky sexual behaviour, self-harm and suicide (Bonomo et al., 2001; Mars et al., 2014; Swahn, Simon, Hammig, & Guerrero, 2004). Hazardous alcohol use in adolescence is associated with a range of alcohol-related harms in adulthood, such as abuse/dependence and progression to other drugs (McCambridge, Mcalaney, & Rowe, 2011; Patton et al., 2007).

Although alcohol consumption during adolescence is widespread, there is a great deal of heterogeneity in the patterns of use. Person-centred methodologies (e.g., latent class analysis, growth mixture modelling) have been used to gain a greater understanding of different alcohol use profiles by identifying latent subgroups of individuals (see Muthén & Muthén, 2000). Latent class analysis has been primarily used to identify distinct classes of adolescent drinkers based on the severity of use (e.g., Heron et al., 2012; Reboussin, Song, Shrestha, Lohman, & Wolfson, 2006). In a UK cohort latent class analysis of trajectories of alcohol use over time led to the identification of high frequency patterns of consumption during mid adolescence (ages 13-15) that predicted hazardous consumption at age 16 (Heron et al., 2012). Membership of this high-risk sub-group was associated with individual and family socio-economic factors, including concurrent tobacco and cannabis use, lower maternal education, larger family size, and living in subsidized housing.

Adolescents also vary in their motives for alcohol use. The motivational model of alcohol use (Cox & Klinger, 1988) emphasises that these underlying motives influence the decision to drink, and thus may prove a promising target for prevention or early intervention initiatives. Past research suggests adolescents with coping motives for drinking, defined as

the use of alcohol to avoid unpleasant emotional states or symptoms (Cooper, Russell, Skinner, & Windle, 1992), are at particular risk of heavy drinking and development of alcohol-related problems (Beseler, Aharonovich, Keyes, & Hasin, 2008; Kuntsche, Knibbe, Gmel, & Engels, 2005; Merrill, Wardell, & Read, 2014). Coping motives for alcohol use are more likely to be reported by adolescents with symptoms of anxiety and depression (Blumenthal, Ham, Cloutier, Bacon, & Douglas, 2015; Comeau, Stewart, & Loba, 2001; Mackie, Conrod, Rijsdijk, & Eley, 2011), suggesting that coping-motivated drinking may represent a self-medication pathway from internalising symptoms to hazardous alcohol use (Hussong, Jones, Stein, Baucom, & Boeding, 2011; Khantzian, 1997).

Person-centred analysis has the potential to enhance understanding of the reasons adolescents drink by identifying the types of motives that cluster together within individuals, and the individual and family factors that characterise these drinker profiles. Two previous studies have applied person-centred analysis and demonstrated considerable variability in adolescent motives for drinking, with some adolescents drinking primarily to experiment or to enhance positive mood states, while others drink primarily to cope with negative emotions (Coffman, Patrick, Palen, Rhoades, & Ventura, 2007; Mackie et al., 2011). In this paper we apply a more focused analysis to examine item-level clustering among coping-related motives specifically. There are two reasons for this: firstly, in view of evidence that coping motives for drinking are most associated with alcohol-related problems and long-term consequences (Beseler et al., 2008; Kuntsche et al., 2005; Merrill et al., 2014). Secondly, previous analyses assume a homogenous set of coping-motives, however alcohol may be used to cope in a varied range of contexts including to manage nervousness, forget worries, feel more self-confident, relieve tension, regulate unwanted fluctuations in mood, or improve depressed mood (Cooper et al., 1992). Particular constellations of coping motives may convey greater risk, and show specific patterns of association with family and individual risk

factors. For example, it follows from theoretical models (e.g., Hussong et al., 2011) that adolescents with an anxiety or depressive disorder would be especially susceptible to use of alcohol to cope with the specific affective experiences associated with these disorders. High-risk alcohol use is also associated with use of other drugs (Reboussin et al., 2006), and family socio-economic background (Heron et al., 2012), although this latter relationship requires clarification as previous work suggests a complex pattern that varies according to the alcohol-related behaviour being measured (Hanson & Chen, 2007; Kendler et al., 2014; Melotti et al., 2011). Identifying the level of risk associated with different patterns of coping-motivated drinking, and the characteristics of adolescents susceptible to these patterns, will help to target and refine early intervention approaches.

The current study explores patterns of coping-motivated drinking formed by late adolescence (age 17-18) in a large UK birth cohort. Our first objective was to use latent class analysis to examine variation in patterns of coping-motivated alcohol use, and identify typologies at greatest risk of alcohol misuse. Our second objective was to explore individual and family characteristics associated with the identified drinker profiles. We hypothesised that specificity would be observed between psychiatric symptoms (depression and anxiety disorders) and profiles characterised by propensity to use alcohol to cope with affect congruent with these disorders. Based on existing evidence of association with alcohol use patterns, we also explored whether the identified typologies were characterised by different sociodemographic characteristics and patterns of other substance use (tobacco, cannabis, illicit drugs).

Materials and Methods

Participants

The sample comprised participants from the Avon Longitudinal Study of Parents and Children (ALSPAC), an ongoing population-based study. The study website contains

details of all data that is available through a fully searchable data dictionary (http://www.bris.ac.uk/alspac/researchers/data-access/data-dictionary). Ethical approval for the study was obtained from the ALSPAC Ethics and Law Committee and the Local Research Ethics Committees for each health district within the study area. All pregnant mothers residing in the former Avon Health Authority in the south-west of England with expected dates of delivery between 1 April 1991 and 31 December 1992 were eligible for the study (total eligible pregnancies = 20,248). We restricted our sample to participants recruited during Phase I (n = 14,541) in order to include covariate information collected during early infancy (this data is not available for participants enrolled during Phase II of recruitment). These pregnancies resulted in 14,062 live births, of which 13,988 were alive at 1 year of age. The catchment area for the study comprises a mixture of rural areas, inner city, leafy suburbs and moderate-sized towns (Golding, Pembrey, & Jones, 2001). Comparisons with the national population indicate an over-representation of more affluent groups and an under-representation of non-White minority ethnic within the sample, which is in part attributable to regional differences (Boyd et al., 2013). The 'eligible sample' remain eligible regardless of their participation history or relocation from the catchment area (questionnaires and invitation to clinical assessments are sent worldwide). For further details on the cohort profile, representativeness and phases of recruitment, see (Boyd et al., 2013). The primary variables of interest in this study came from data collected at the age 17-18 "Teen Focus 4" research clinic. All enrolled participants were invited to attend this clinic with the exception of those lost to follow-up due to death, study withdrawal, and those who were untraceable. Data is available for 4,881 participants who attended the clinic. The mean age of participants was 17 years and 10 months (inter-quartile range: 17 years, 7 months to 17 years, 11 months).

Measures

Alcohol and Substance Use. Alcohol and substance use was assessed by computerised interview at the age 17-18 clinic. The Alcohol Use Disorders Identification Test (AUDIT) comprises 10 items to assess alcohol consumption and alcohol-related problems over the past year. Consumption items were used to derive two variables indicating i) alcohol use frequency (never/irregular use/weekly or more often); ii) quantity of standard drinks typically consumed (none/1or 2/3 or 4/5 or 6/ 7 or more). Total AUDIT scores were used to index alcohol use severity: scores above 8 indicate hazardous alcohol use, and scores above 15 indicate a high level of alcohol-related problems (Babor, Higgins-Biddle, Saunders, & Monteiro, 2001). A variable to indicate probable alcohol dependence was derived from 10 additional questions assessing ICD-10 dependence symptoms during the past year. Past research supports the use of these diagnostic criteria during late adolescence (Mewton, Teesson, Slade, & Cottler, 2011). Probable alcohol dependence was defined as endorsement of 3 or more of these dependence symptoms.

Participants were also asked about the use of tobacco, cannabis, cocaine, amphetamines, inhalants, sedatives, hallucinogens or opioids in the previous 12 months. Three variables were derived to indicate i) tobacco use (non-smoker/irregular use/weekly or more often); ii) cannabis use (no/yes); and iii) any (non-cannabis) illicit drug use (no/yes).

Drinking to Cope. Self-reported coping motives were assessed at the age 17-18 clinic using the scale originally developed by Cooper et al. (1992). The five original items from this scale assess how often over the past 2 years participants have used alcohol to relax, forget worries, cheer up, cope with depression or nervousness, or feel more self-confident. We made two modifications to the 5 original items: we split the “cope with depression or nervousness” item into two items to separately assess coping with depression/nervousness, and we added an item to assess drinking to cope with fluctuations in mood (“drinking to help when your

mood changes a lot"). Good internal consistency was observed for this modified version of the scale (α = 0.79). Participants indicate how often they have consumed alcohol for each reason (7 motives in total) on a 4-point scale: 0 "almost never", 1 "sometimes", 2 "often", 3 "almost always". To reduce model complexity and facilitate a parsimonious latent class solution, responses for all items were collapsed to form a binary variable indicating no use (coded 0) versus use (coded 1) of alcohol for each coping motive.

Socio-demographic variables. We focussed on socio-demographic indicators collected during pregnancy because these data were most complete and past research highlights the influence of social adversity during early childhood particularly on health outcomes (Taylor, Way, & Seeman, 2011). The following socio-demographic information was collected pre-birth based on maternal report: housing tenure (coded as owned/mortgaged, privately rented, or subsidised rental), maternal educational attainment (coded as no high school qualifications, high school, beyond high school), and parental social class ranked from high to low at five intervals using standard occupational classification (Office of Population Censuses and Surveys, 1991). In addition, quintile bands of household disposable income accounting for family size and composition were calculated from average income data collected at child age 33 and 47 months old (see Melotti et al., 2011).

Anxiety and Depressive Disorders. At the age 17-18 research clinic, participants completed a self-administered computerized version of the Clinical Interview Schedule – Revised (CIS-R; Lewis, 1994). This interview assesses current symptoms across multiple domains, and computer algorithms are used to identify psychiatric disorders according to ICD-10 diagnostic criteria (Lewis, 1994). The CIS-R is designed for, and has been widely used within, community samples (e.g., Clark, Rodgers, Caldwell, Power, & Stansfeld, 2007). Good agreement has been demonstrated between administration by a clinically trained interviewer, lay interviewer or self-administration using the computerised version (Lewis,

1994). For this study we derived two binary variables to indicate presence versus absence of: i) depressive disorder; and ii) any anxiety disorder (incorporating generalized anxiety disorder, social phobia, specific (isolated) phobia, panic disorder, or agoraphobia).

Data Scoring and Analysis

Descriptive statistics were obtained using STATA (release 12.0) software. The primary analysis proceeded in two phases. First, latent class analysis (LCA) using Mplus software (version 7.11) was used to identify typologies of alcohol use motives across the 7 binary drinking to cope indicators. The analysis was restricted to participants who reported they consumed alcohol in the past year. LCA examines response patterns (in a manner similar to factor analysis) and assumes variability is related to latent (unobserved) sub-groupings within the population. The number of latent classes was determined by estimating a series of latent class models with an incrementally greater number of classes, starting from a single class model. The final class solution was selected with reference to the following model fit statistics: i) the sample-size adjusted Bayesian information criterion (aBIC; Sclove, 1987); ii) conditional independence and the number of ill-fitting bivariate residuals (Muthén, 2003); iii) the Bootstrap Likelihood Ratio Test (Mclachlan & Peel, 2004) which assesses model-fit improvement with the addition of each class; and iv) the Lo-Mendell Rubin adjusted likelihood ratio test (Lo, Mendell, & Rubin, 2001). The interpretability and utility of the solution were also considered, particularly when model fit statistics did not point to a single optimal model (Muthén, 2003). A well differentiated class solution is desirable, thus entropy (an index of class separation based on the posterior class membership probabilities; Celeux & Soromenho, 1996) was considered when comparing models with two or more classes. For each model, multiple random starts (3000 initial stage and 300 final stage) were used to ensure the optimal maximum likelihood solution was reached. Possible gender differences in class solutions were examined by estimating separate models using the "knownclass" option.

In the second phase, covariates (severity of alcohol/other substance use, socio-demographic characteristics, internalising disorders) were added one at a time to the latent class model to examine the association (expressed as an odds ratio) with latent class membership. For categorical covariates, probabilities at each level given latent class membership were calculated, and class differences assessed using a Wald test.

Missing Data. Compared to participants who attended the age 17-18 clinic, those who did not attend were more likely to be male, and came from families experiencing higher levels of social adversity (financial difficulties, housing inadequacy, parental police convictions, maternal mental health symptoms, family relationship problems, lack of supportive networks, lower maternal education; see supplementary material for full details). Consequently, we developed a model to predict data attrition and conducted sensitivity analyses using inverse probability weighting (IPW) to examine whether our results were likely to be biased. IPW is considered preferable for handling missing data in cases where an adequate multiple imputation (MI) model cannot be specified (see Seaman & White, 2013). In our case, this method was utilised as the majority of the participants provided either all or none of the key measures included in our analysis so auxiliary information (such as would inform an MI) was sparse amongst non-responders. For full details of the IPW procedure undertaken, see Supplementary Material.

Results

Alcohol Consumption and Coping Motives

Alcohol use and drinking to cope questions were completed by 3,957 participants, of whom 92% reported any alcohol use in the past year. The majority of adolescents who had tried alcohol reported drinking less often than weekly, while 26% reporting they drank weekly or more often. Table 1 displays descriptive characteristics for adolescents who did versus did not report alcohol consumption. Participants who reported no alcohol consumption

in the past year were excluded from subsequent analyses (n = 307). Among the 3,645 adolescents who drank alcohol in the past year, coping motives were common, particularly drinking to relax, to feel more self-confident and drinking to cheer up (see Table 2).

Latent class analysis

We examined models and fit indices for one-class to six-class solutions. Comparison of models estimated separately for boys and girls indicated no improvement in model fit (aBIC) over a single sample model. The latent class solutions derived from models within each gender showed good agreement, thus final models incorporated both genders within the same model. Detailed model fit information is provided in supplementary Table S1. The four-class model was clearly superior based on aBIC and comparisons of conditional independence, with no improvement indicated for subsequent class additions. There was weak evidence (p = 0.039) based on the Lo-Mendell Rubin adjusted LRT to suggest a further improvement in fit for the five class solution. However, visual inspection of the estimated item probability plots suggested poor discrimination and face validity associated with the fifth class. We thus proceeded with the four-class solution in the interests of parsimony and in view of the poorer entropy estimate for the five-class solution (0.65). The entropy value for the four class model (0.70) indicates moderate classification of participants.

Figure 1 shows the resulting four patterns of drinking to cope motives. The largest class with an estimated proportion of 35.5% was characterised by low or very low endorsement of all coping motives. This class was labelled “Rarely drinks to cope”. We labelled the next most common class (26.6%) “Confidence motives”, as this group was characterised by high probability of drinking for self-confidence and relaxation, along with moderate probability of drinking to help with nervousness or to cheer-up. The “Low Mood motives” class (19.4%) was differentiated from the preceding classes by high probability of

drinking to cheer-up, and comparatively high probability of drinking to help when depressed and to forget worries. Finally, the smallest class (18.5%) represented the most extreme group, with high probabilities for all coping motives. We labelled this class "Generalised coping motives" to reflect this pattern of drinking to cope with emotional experiences across the board. Examination of the mean coping motives endorsed by participants indicated the classes reflected a continuum of severity from ("Rarely drinks to cope") at the lower end (mean of 0.5 motives endorsed) to "Generalised motives" at the higher end (mean of 6.0 motives endorsed). The "Confidence" and "Low Mood" classes both reflected a moderate level of severity in terms of mean number of motives endorsed (2.7 and 3.4 respectively), and these classes were differentiated by the types of coping-motives identified, indicating these groups were defined by the nature of the experience rather than severity.

Latent Class Membership and Alcohol/Substance Use

A series of models incorporating alcohol and substance use covariates were estimated. The latent class solution was unchanged when estimated together with these covariates: inclusion of alcohol and substance use variables made little difference to the proportion of participants and the pattern of coping motive endorsement within each class. This indicates that the identified class solution was independent of severity of alcohol consumption. There was strong evidence for an association between latent class membership and severity of alcohol use and other substances (see Figure 2). Compared with other classes, the "Generalised motives" class was characterised by greater consumption of alcohol, higher probability of alcohol-related problems, and more symptoms of alcohol dependence. Risk of alcohol-related problems was similar for the "Confidence" and "Low Mood" classes, and in both cases higher than the "Rarely drinks to cope" class. However, compared to the "Confidence" class, those with "Low Mood" motives were more likely to report typical consumption of 7 or more standard drinks. The "Generalised motives" class clearly

represents the highest risk group in terms of consumption and alcohol-related problems, while those in the "Rarely drinks to cope" class represent a low risk group.

There was evidence that class membership was associated with different patterns of use for substances other than alcohol. Membership of the "Generalised motives" class was associated with highest rates of tobacco, cannabis and illicit drug use, while the "Rarely drinks to cope" class were at lowest risk of using these substances. Cannabis and illicit drugs were used at similar levels in the "Confidence" and "Low Mood" classes; however regular tobacco use was more likely for those in the "Low Mood" class.

Latent Class Membership and Socio-demographic profile

There was strong evidence that latent class membership was associated with different socio-demographic profiles (see Table 3). Females were more likely to belong to the "Generalised motives" or "Low Mood" classes. The "Confidence" class was associated with higher socio-economic position compared to all 3 other classes. Membership of the "Confidence" class was more likely for adolescents with parents who were home-owners, in the professional class, and with highest disposable income. There was a complex relationship between maternal education and class membership. Membership of the "Confidence" class was associated with higher maternal education, whereas adolescents of mothers with no high-school qualifications were comparatively more likely to be in the "Low Mood" class. The differing socio-demographic profiles observed for the "Low Mood" and "Confidence" classes again provide evidence that these represent qualitative distinct typologies.

Latent Class Membership and Internalising Disorders

There was strong evidence that concurrent internalising disorders were associated with latent class membership. Odds ratios for membership of each class compared to the reference group "Rarely drinks to cope" are shown in Table 4. Adolescents diagnosed with

depression at the age 17-18 clinic were more likely to be in the "Low Mood" or "Generalised motives" classes. This association was greatest for the "Generalised motives" class: depressed adolescents were six times more likely to be members of this class compared to the "Rarely drinks to cope" class. Adolescents diagnosed with anxiety were more likely to be members of all three coping classes compared to the "Rarely drinks to cope" class. Again, the strongest association was for the "Generalised motives" class: an anxiety diagnosis at age 17-18 was associated with a six to sevenfold increase in odds of being in the "Generalised motives" class.

Missing Data

The results of sensitivity analyses with cases weighted by inverse probabilities are shown in supplementary tables (Tables S2-S4). These sensitivity analyses confirmed our conclusions, with no material difference to the pattern of results derived from complete-case analyses.

Discussion

Latent class analysis to explore patterns of self-reported coping motives for drinking identified four distinct typologies: 35.5% of adolescents were characterised by low endorsement of all coping motives ("Rarely drinks to cope"); over 1 in 5 (26.6%) were characterised by high probability of drinking for self-confidence and relaxation ("Confidence motives"); nearly 1 in 4 (19.4%) were differentiated by higher probability of drinking to cheer-up, forget worries, and to help when depressed ("Low Mood motives"); and the smallest latent class (18.5%) was characterised by a pattern of drinking to cope with emotional experiences across the board ("Generalised coping motives"). The identified coping sub-types were associated with different profiles of alcohol and substance use severity. The "Generalised motives" class and "Rarely drinks to cope" class appeared to reflect a severity continuum, and represented a high-risk and low-risk group respectively in

terms of risk for harmful alcohol and substance use. Meanwhile the "Confidence motives" and "Low Mood motives" were defined instead by the types of coping-motives identified, and were characterised by different socio-demographic profiles, indicating these groups were qualitatively rather than quantitatively different. Membership of the high-risk "Generalised motives" class was strongly associated with anxiety and depressive disorders, consistent with the hypothesised internalising pathway to risky alcohol consumption in adolescence (Hussong et al., 2011).

Strengths and Limitations

Like most longitudinal studies, the current study is limited by attrition over time. Nonetheless, we are reassured by the results of our sensitivity analysis which indicated the same pattern of results when inverse probability weighting was used to adjust for response attrition. The cohort was drawn from a specific region within the United Kingdom and thus there are potential limits to generalisability to other regions and countries. A third potential limitation is the reliance on self-report assessment of alcohol use, which is by nature subjective and might lead to measurement errors. However, research supports self-report as a reliable and valid method of assessing alcohol consumption (Del Boca & Darkes, 2003), and we are confident the tendency to exaggerate or under-estimate use was minimised in this study as participants completed questionnaires individually and were assured of the anonymity of their responses. Finally, the current study was cross-sectional and focussed on profiling typologies of drinking motives, and therefore does not allow inferences about causation. Moreover, the unique contribution of each sociodemographic measure to prediction of class membership was not assessed due to the strong correlation between these measures. These limitations notwithstanding, this study capitalises on the wealth of data collected from a large representative cohort to identify individual and family characteristics associated with four distinct adolescent drinking typologies. Well-validated instruments

assessment were used to assess alcohol and drug use, and socio-economic status was measured across a variety of mother-reported indicators, thus circumventing difficulties associated with adolescent report of parents' occupation, education and income. Although cross-sectional, this study is the first to examine the types of coping motives that cluster together within individuals, and suggests potential pathways to high-risk drinking for examination in future research.

Drinking to Cope and Socio-economic Factors

The relationship between alcohol outcomes and socioeconomic status is complex (see Hanson & Chen, 2007), with previous investigations in the ALSPAC cohort indicating that higher socioeconomic status is associated with lower risk of alcohol-related problems but more frequent alcohol consumption, which may reflect greater availability of spending money and alcohol (Kendler et al., 2014). The current study extends this work by showing that adolescents' motives for drinking also vary according with socioeconomic background. Adolescents from families with higher disposable income, social status and education levels were more likely to report drinking for "Confidence" motives. In contrast, adolescents with less educated mothers were more likely to drink for "Low Mood" motives. This finding of distinctly different drinking motives within these two groups may reflect differences in life circumstances and/or modelling of drinking norms within families and communities. Adolescents from disadvantaged backgrounds tend to experience more daily stressors, including higher rates of crime, financial hardship and inadequate resources (Santiago, Wadsworth, & Stump, 2011). In addition, social adversity is associated with poorer family relations, which in turn impacts on mental health (Gonzales et al., 2011). The finding of greater risk of drinking for "Low Mood" motives among disadvantaged adolescents may reflect a more frequent experience of low mood, and/or limited access to support or mood regulation strategies. Meanwhile, for adolescents from more affluent families, the use of

alcohol for confidence motives may reflect a greater emphasis on social standing and impression management. One approach to reducing social inequalities in health outcomes has been to specifically target high-risk groups, for example selectively delivering prevention within schools in low socio-economic areas (Gonzales, Dumka, Deardorff, Carter, & Mccray, 2004). Our findings raise the hypothesis that the development of adaptive strategies to cope with low mood may be a particularly important intervention component for adolescents from disadvantaged backgrounds.

Drinking to Cope and High-risk Alcohol and Drug use

The identified coping sub-types were associated with different alcohol and drug use profiles. While the "Low Mood" and "Confidence" classes were associated with similar risk of alcohol-related problems, those with "Low Mood" motives were more likely to report a typical pattern of binge-drinking. Interestingly, the "Low Mood" and "Self-confidence" classes were also differentiated by frequency of tobacco but not cannabis and illicit drug use, suggesting different expectancies associated with these different drug types. Tobacco use was more common among those with "Low Mood" motives, consistent with previous work indicating tobacco is used by adolescents to regulate mood (Hedeker, Mermelstein, Berbaum, & Campbell, 2009). There was some evidence for specificity between psychiatric symptoms and motive classes, with adolescents with diagnosed depression more likely than the low risk group to belong to the "Low Mood" but not "Confidence" class.

The "Generalised motives" class clearly represented the most vulnerable group with greatest consumption of alcohol, highest probability of alcohol-related problems, more symptoms of alcohol dependence, and strongest association with anxiety and depressive disorders. This group was also at greater risk of other drug use, with highest rates of tobacco, cannabis and illicit drug use, raising the possibility that these adolescents engage in coping-motivated use of multiple substances. Adolescents in the "Generalised motives" class were

more likely to be female, consistent with existing evidence that women are more likely to drink to cope (Rice & Van Arsdale, 2010; Timko, Finney, & Moos, 2005). This finding may reflect the greater prevalence of internalising symptoms in women, and raises the hypothesis that habitual coping mechanisms may have already formed by late adolescence. Membership of this high-risk "Generalised motives" class appeared to be independent of social patterning with no evidence of association with socio-economic indicators. Development of drinking profiles characterised by generalised coping motives may be related to other factors such as presence of anxiety and depression, biological predisposition (Mackie et al., 2011), or family environment factors such as modelling of parents' drinking behaviour.

A number of implications follow from this study. Our data suggest the "Generalised motives" profile of drinking is a risk marker for harmful alcohol use and alcohol dependence. Prospective analyses suggest coping motives precede and contribute to the development of alcohol-related problems and dependence (Beseler et al., 2008; Merrill et al., 2014), and reductions in coping-related drinking over time are associated with greater recovery and fewer alcohol-related problems (Timko et al., 2005). Therefore, adolescents who identify use of alcohol to cope with a broad range of emotions may benefit from early intervention aimed at developing alternate coping strategies. Consistent with the self-medication hypothesis (Hussong et al., 2011; Khantzian, 1997) adolescents with diagnosed anxiety and depression were six times more likely to fall within this high-risk "Generalised motives" drinking profile. This finding supports the use of interventions targeting anxiety and depression symptoms during adolescence, which may prevent alcohol use problems by reducing maladaptive coping-motivated drinking (Teesson et al., 2014). Evidence of specificity between symptoms of depression and greater risk for the "Low Mood" but not "Confidence" class highlights the potential benefits of targeting interventions towards particular vulnerabilities and motives for drinking. One such approach is the Preventure program, which

has been shown to reduce adolescent drinking by targeting high-risk personality styles (including hopelessness and anxiety sensitivity) and fostering development of personality-specific coping strategies (Conrod, Castellanos-Ryan, & Mackie, 2011).

Conclusions

This study suggests coping motives for drinking are common among adolescents, although drinking profiles vary by socio-economic background. Confidence motives appear more common among adolescents from high socio-economic backgrounds, while Low Mood motives are more common among females and adolescents from less educated families. Adolescents at highest risk of hazardous drinking and alcohol dependence are those who drink to cope with emotional experiences across the board. Our findings suggest females are most susceptible to these high-risk drinking motives. The results are consistent with the self-medication hypothesis, as adolescents diagnosed with an anxiety or depressive disorder were six times more likely to fall within the high-risk drinking profile. Adolescents who report the use of alcohol to cope with a broad range of emotions may benefit from early intervention to promote the development of adaptive coping skills.

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Ethical Approval: All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed Consent: Informed consent was obtained from all individual participants included in the study.

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Table 1. Descriptive data according to alcohol consumption status at age 17-18

	Analysis Sample (*n* = 3,645)	**Non-drinkers** (*n* = 307)
Alcohol Use		
Drinking frequency		
Never	0.0%	100.0%
Less than weekly	74.0%	
Weekly	26.0%	
Drinking quantity		
None	0.0%	100.0%
1 or 2 units	21.7%	
3 or 4	28.3%	
5 or 6	26.1%	
7+	24.0%	
Probable Alcohol Dependence	3.5%	0.0%
AUDIT total score (M, *sd*)	7.5 *(4.6)*	N/A
Socio-demographic indicators		
Female	56.0%	55.6%
Housing tenure		
Mortgaged/owned home	86.5%	84.1%
Rented	7.3%	5.8%
Subsidized Housing	7.2%	10.2%
Disposable income		
High	24.5%	25.6%
Middle High	22.9%	22.1%
Middle	21.4%	16.3%
Middle Low	17.8%	22.9%
Low	13.4%	13.2%
Parental social class		
I Professional	19.0%	19.1%
II Managerial/Technical	46.0%	44.4%
III Skilled Non-manual	22.7%	22.7%
IV Skilled Manual	8.7%	8.7%
IV & V: Partly Skilled/Unskilled	3.6%	5.1%
Maternal education		
Beyond high school	19.6%	20.5%
High School qualifications	62.3%	57.3%
No high School qualifications	18.0%	22.2%

Table 2. Percentage of adolescents reporting each coping motive for drinking (n= 3645)

Drinking to Cope Item	**% yes**
1. To help when you feel nervous	28.9%
2. To feel more self-confident and sure of yourself	56.7%
3. To relax	62.7%
4. To forget your worries	29.1%
5. To cheer up when you're in a bad mood	49.2%
6. To help when you feel depressed	27.9%
7. To help you when your mood changes a lot	13.9%

Table 3. Socio-demographic characteristics associated with latent class membership

Socio-demographic	*N*	Rates (%, *standard error*) by Class membership				Omnibus Test (Wald)
		Rarely drinks to cope	Confidence motives	Low Mood motives	Generalised Coping	
Sex	3,638					$\chi^2 = 33.4$, $df = 3$, $p < 0.001$
Male		48.8 *(1.6)*	46.6 *(2.5)*	39.3 *(3.0)*	35.4 *(2.1)*	
Female		51.2 *(1.6)*	53.4 *(2.5)*	60.7 *(3.0)*	64.6 *(2.1)*	
Odds Ratio (linear term)		1.0 [ref]	1.09 [0.84–1.42]	1.47 [1.12–1.93]	1.74 [1.39–2.17]	
Housing tenure	3,536					$\chi^2 = 21.0$, $df = 6$, $p = 0.002$
Mortgaged/owned home		84.3 *(1.1)*	90.9 *(1.2)*	81.9 *(2.0)*	83.6 *(1.7)*	
Rented		6.9 *(0.8)*	6.0 *(1.0)*	8.2 *(1.4)*	8.9 *(1.3)*	
Subsidized Housing		8.8 *(0.9)*	3.1 *(0.8)*]	9.9 *(1.5)*	7.5 *(1.2)*	
Odds Ratio (linear term)		1.0 [ref]	0.62 [0.49–0.79]	1.10 [0.90–1.33]	0.98 [0.82–1.17]	
Disposable income	3,223					$\chi^2 = 33.9$, $df = 12$, $p < 0.001$
High		22.3 *(1.4)*	31.8 *(2.0)*	20.0 *(2.3)*	22.4 *(2.0)*	
Middle High		22.8 *(1.4)*	24.7 *(1.9)*	22.8 *(2.4)*	20.5 *(1.9)*	
Middle		21.7 *(1.3)*	20.6 *(1.7)*	20.0 *(2.2)*	23.4 *(2.0)*	
Middle Low		17.4 *(1.3)*	15.1 *(1.6)*	21.6 *(2.3)*	18.8 *(1.8)*	
Low		15.8 *(1.2)*	7.7 *(1.2)*	15.6 *(2.0)*	14.9 *(1.6)*	
Odds Ratio (linear term)		1.0 [ref]	0.80 [0.73–0.88]	1.05 [0.95–1.15]	1.01 [0.93–1.10]	
Parental social class	3,359					$\chi^2 = 46.3$, $df = 12$, $p < 0.001$
Professional		16.7 *(1.2)*	28.3 *(1.9)*	13.1 *(2.0)*	16.1 *(1.7)*	
Managerial/Technical		47.1 *(1.6)*	45.1 *(2.1)*	45.8 *(2.6)*	45.3 *(2.2)*	
Skilled Non-manual		23.3 *(1.4)*	17.8 *(1.7)*	26.2 *(2.3)*	25.6 *(1.9)*	
Skilled Manual		8.8 *(0.9)*	6.8 *(1.1)*	10.1 *(1.6)*	9.4 *(1.3)*	
Partly Skilled/Unskilled		4.2 *(0.6)*	2.0 *(0.7)*	4.8 *(1.2)*	3.6 *(0.8)*	
Odds Ratio (linear term)		1.0 [ref]	0.73 [0.63–0.83]	1.12 [0.99–1.26]	1.02 [0.92–1.14]	
Maternal education	3,497					$\chi^2 = 78.4$, $df = 6$, $p < 0.001$
Beyond high school		16.1 *(1.2)*	34.0 *(2.4)*	12.4 *(1.7)*	15.7 *(1.6)*	
High School quals		64.4 *(1.5)*	55.8 *(2.2)*	61.6 *(2.4)*	67.4 *(2.1)*	
No high school quals		19.5 *(1.3)*	10.2 *(1.7)*	26.0 *(2.3)*	16.9 *(1.7)*	
Odds Ratio (linear term)		1.0 [ref]	0.45 [0.35–0.58]	1.36 [1.09–1.68]	0.94 [0.79–1.12]	

Table 4. Association between latent class membership and internalising disorders

	N	Odds Ratios for Latent Classes (Reference group: Rarely drinks to cope)			Omnibus Test (Wald)
		Confidence motives	Low Mood motives	Generalised Coping motives	
Internalising disorders					
Depression diagnosis at age 17-18	3,478				$\chi^2 = 50.7$, $df = 2$, $p < 0.001$
No		1.00 ref	1.00 ref	1.00 ref	
Yes		1.46 [0.93 to 2.30]	2.26 [1.39 to 3.69]	6.03 [4.32 to 8.42]	
Anxiety diagnosis at age 17-18	3,478				$\chi^2 = 44.8$, $df = 2$, $p < 0.001$
No		1.00 ref	1.00 ref	1.00 ref	
Yes		2.42 [1.64 to 3.58]	2.55 [1.66 to 3.93]	6.77 [4.91 to 9.34]	

Figure 1. Probability (with standard error) of endorsing each coping motive by latent class

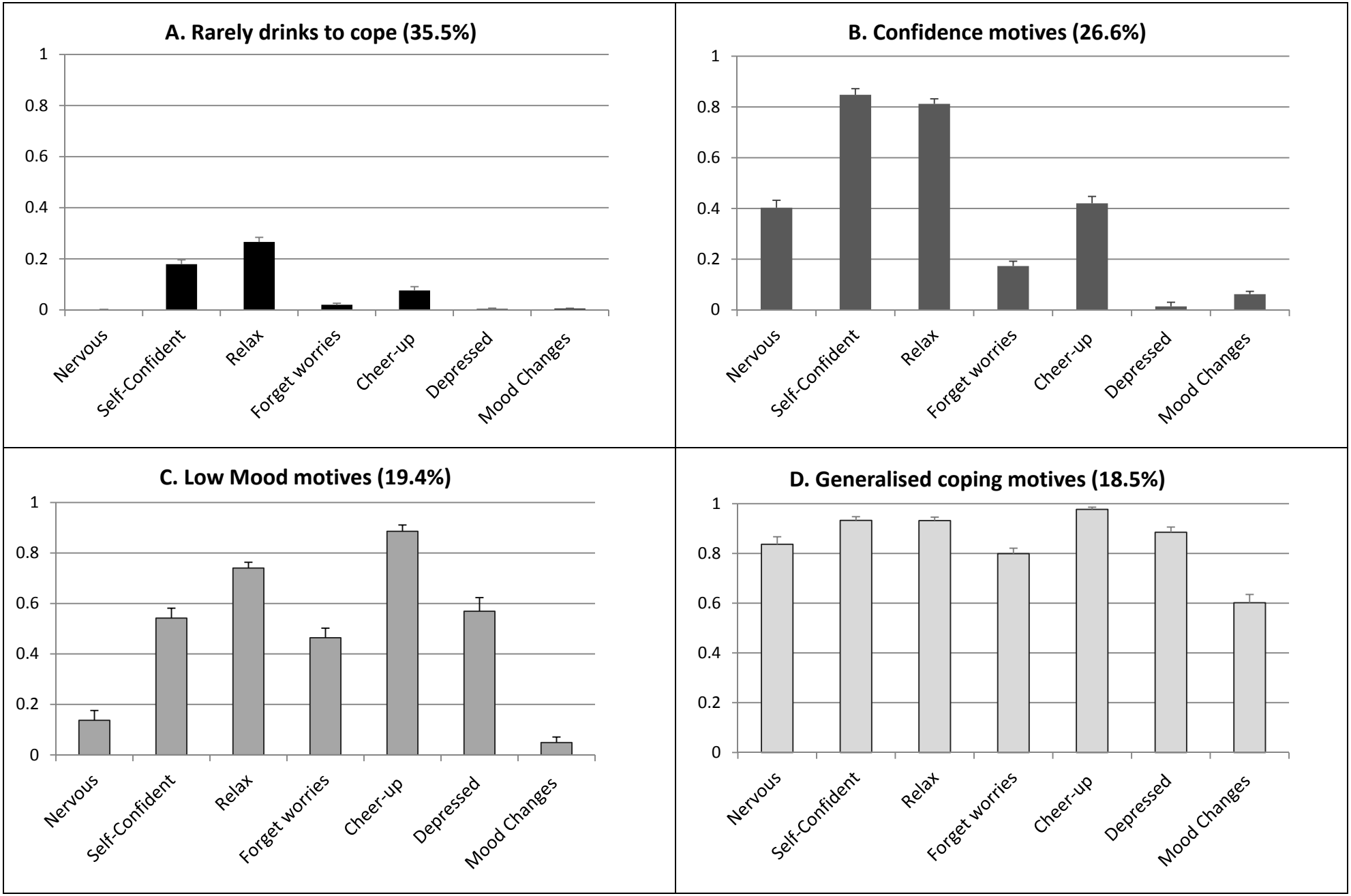
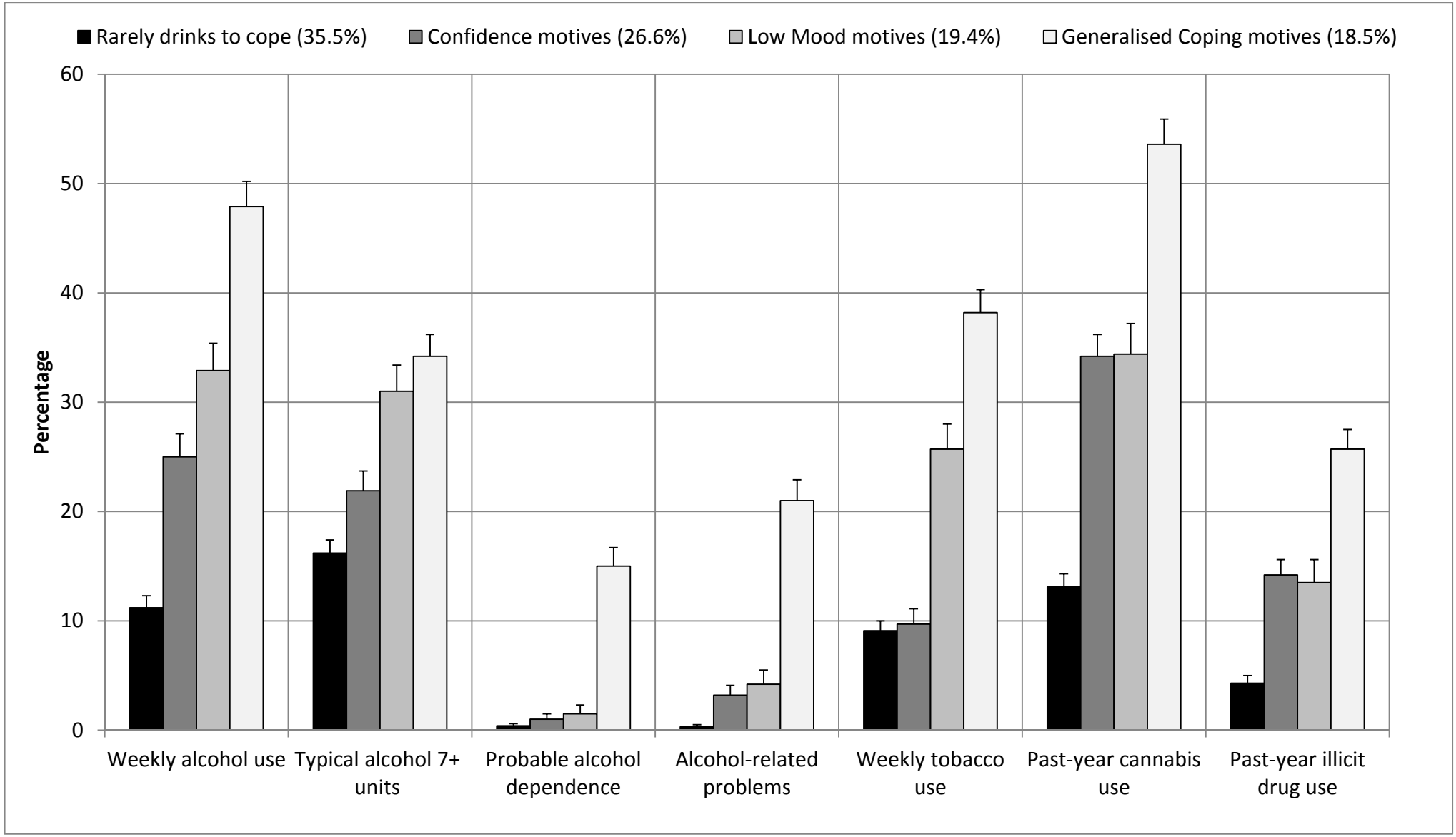


Figure 2. Rate (with standard error) of alcohol and substance use characteristics associated with latent class membership



Note. There was strong evidence for class differences on all variables, omnibus Chi^2 test (Wald) ranged from $\chi^2 = 123.7$ to $\chi^2 = 492.5$; *n* ranged from 3,553 to 3,638; all p values < 0.001.

Table S1. Model fit statistical for determining optimal latent class solution

Fit Indicator	Model					
	1 class	2 class	3 class	4 class	5 class	6 class
aBIC	30,906.9	26,219.0	25,514.3	25,226.9	25,230.6	25,244.1
Entropy	N/A	0.80	0.73	0.70	0.65	0.71
Conditional independence	10,416.7	624.7	233.6	8.9	4.2	3.1
# bivariate residuals >0.05	84	35	15	0	0	0
BLRT	N/A	4728.1 $p < 0.001$	745.0 $p < 0.001$	327.6 $p < 0.001$	36.4 $p < 0.001$	26.4 $p = 0.003$
Lo-Mendell-Rubin Adjusted LRT Test	N/A	4657.1 $p < 0.001$	733.8 $p < 0.001$	322.6 $p < 0.001$	35.9 $p = 0.039$	26.8 $p = 0.055$
Frequency (modal class) in smallest class	3,645	1,383	762	642	591	429

Note. Sample size for Latent Class Analysis: $n = 3645$. Entropy, BLRT and Lo-Mendell-Rubin LRT cannot be calculated for a one-class model.

Table S2. Rate of alcohol and substance use characteristics associated with latent class membership

	N	Rates (%, *standard error*) of use by Class membership				Omnibus Test (Wald)
		Rarely drinks to cope	Confidence motives	Low Mood motives	Generalised Coping motives	
Alcohol use frequency	3,638					$\chi^2 = 211.7$, $df = 3$, $p < 0.001$
Irregular		88.8 *(1.1)*	75.0 *(2.1)*	67.1 *(2.5)*	52.1 *(2.3)*	
Weekly or more		11.2 *(1.1)*	25.0 *(2.1)*	32.9 *(2.5)*	47.9 *(2.3)*	
Alcohol use typical quantity	3,632					$\chi^2 = 199.3$, $df = 9$, $p < 0.001$
1 or 2 units		34.3 *(1.5)*	17.6 *(1.7)*	14.5 *(2.0)*	11.4 *(1.4)*	
3 or 4		27.2 *(1.4)*	34.4 *(1.9)*	28.3 *(2.3)*	21.9 *(1.8)*	
5 or 6		22.3 *(1.3)*	26.1 *(1.9)*	26.2 *(2.3)*	32.5 *(2.0)*	
7+		16.2 *(1.2)*	21.9 *(1.8)*	31.0 *(2.4)*	34.2 *(2.0)*	
Probable Alcohol Dependence	3,636	0.4 *(0.2)*	1.0 *(0.5)*	1.5 *(0.8)*	15.0 *(1.7)*	$\chi^2 = 128.3$, $df = 3$, $p < 0.001$
AUDIT score	3,630					$\chi^2 = 492.5$, $df = 6$, $p < 0.001$
Low risk		81.8 *(13)*	56.4 *(2.6)*	46.9 *(3.1)*	23.7 *(1.9)*	
Risky/hazardous		17.9 *(13)*	40.4 *(2.4)*	48.9 *(2.8)*	55.3 *(2.1)*	
High risk		0.3 *(0.2)*	3.2 *(0.9)*	4.2 *(1.3)*	21.0 *(1.9)*	
Tobacco smoking	3,619					$\chi^2 = 338.5$, $df = 6$, $p < 0.001$
Non-smoker		86.4 *(1.1)*	76.2 *(2.0)*	59.1 *(2.7)*	44.2 *(2.2)*	
Smoked in last 30 days		4.4 *(0.7)*	14.1 *(1.5)*	15.3 *(1.9)*	17.6 *(1.6)*	
Regular (weekly or more)		9.1 *(0.9)*	9.7 *(1.4)*	25.7 *(2.3)*	38.2 *(2.1)*	
Cannabis Use	3,577					$\chi^2 = 223.2$, $df = 3$, $p < 0.001$
No		86.9 *(1.2)*	65.8 *(2.0)*	65.6 *(2.8)*	46.4 *(2.3)*	
Used in past 12 months		13.1 *(1.2)*	34.2 *(2.0)*	34.4 *(2.8)*	53.6 *(2.3)*	
Illicit Drug Use	3,553					$\chi^2 = 123.7$, $df = 3$, $p < 0.001$
No		95.7 *(0.7)*	85.8 *(1.4)*	86.5 *(2.1)*	74.3 *(1.8)*	
Used in past 12 months		4.3 *(0.7)*	14.2 *(1.4)*	13.5 *(2.1)*	25.7 *(1.8)*	

[1] rates are expressed as percentages

Note. Illicit drug use incorporates any use of cocaine, amphetamines, inhalants, sedatives, hallucinogens or opioids in the previous 12 months. This data is summarized in Figure 1.

Missing Data: Method for Sensitivity Analyses

We used inverse probability weighting (IPW) to conduct sensitivity analyses and examine whether our results were likely to be biased. IPW is considered preferable for handling missing data in cases where an adequate multiple imputation (MI) model cannot be specified (see Seaman and White, 2013). In our case, this method was utilised as the majority of the participants provided either all or none of the key measures included in our analysis so auxiliary information (such as would inform an MI) was sparse amongst non-responders. The IPW approach consists of using baseline information to construct a logistic model for whether or not participants are included in the substantive model of interest. Predicted probabilities from this logistic model are then converted into importance weights. For instance, if males had a 50% chance of being in the final model, then males would be given a weight of two.

In the current study a nested approach was adopted in which two prediction models were created. The first logistic model was for a binary indicator of attendance at the 17-18 year clinic (yes/no amongst the cohort of 13,988) and the second model predicted completion of drinking to cope questions at the clinic (yes/no amongst the sample of 4,881 who attended the clinic). Different covariates were used for these two prediction models to reflect the different likely reasons for missing response at these time-points. Covariates for the first model were a range of family adversity and socio-demographic indicators from maternal report collected between pregnancy and child age 5. For the second, candidates were proximal data on psychiatric symptoms, behavioural problems, prior reports of alcohol and drug use, and observer reports of participant discomfort, confusion or boredom during the clinic. The Hosmer–Lemeshow test was used to assess the fit of the two models of missingness. To perform the sensitivity analysis, cases were weighted by the combined inverse probability weightings from these two models, and results were compared with the primary (unweighted) analyses.

Of the original cohort of 13,988 participants, 4,881 attended the age 17-18 research clinic, and 3,957 completed the alcohol use and drinking to cope questions. The model to predict attendance vs absence at the age 17-18 included the following family predictors of non-attendance: car use, financial difficulties, housing adequacy, social network, parental police convictions, family relationship problems, maternal education and mental health symptoms, child's sex (n = 11,847). The model to predict missing responses to alcohol questions among those who attended the age 17-18 clinic included the following family predictors of missingness: child's sex, age, and depression symptoms at previous assessment points (n = 4,107)

Table S3. Sensitivity Analysis with Inverse Probability Weighting: Rate of alcohol and substance use associated with latent class membership

	N	Rates (%, *standard error*) of use by Class membership				Omnibus Test (Wald)
		Rarely drinks to cope	Confidence motives	Low Mood motives	Generalised Coping motives	
Alcohol use frequency	3,135					$\chi^2 = 150.1$, $df = 3$, $p < 0.001$
Irregular		89.5 *(1.3)*	72.4 *(2.2)*	70.3 *(2.9)*	50.3 *(2.8)*	
Weekly or more		10.5 *(1.3)*	27.6 *(2.2)*	29.7 *(2.9)*	49.7 *(2.8)*	
Alcohol use typical quantity	3,131					$\chi^2 = 144.1$, $df = 9$, $p < 0.001$
1 or 2 units		33.2 *(1.7)*	17.1 *(1.9)*	14.3 *(2.5)*	11.3 *(1.5)*	
3 or 4		27.0 *(1.6)*	33.8 *(2.1)*	27.0 *(2.7)*	22.1 *(2.1)*	
5 or 6		22.3 *(1.5)*	26.5 *(2.1)*	27.5 *(2.9)*	30.9 *(2.3)*	
7+		17.5 *(1.4)*	22.6 *(2.0)*	31.3 *(2.8)*	35.7 *(2.4)*	
Probable Alcohol Dependence	3,133	0.3 *(0.2)*	1.3 *(0.7)*	2.1 *(1.3)*	16.2 *(2.1)*	$\chi^2 = 128.3$, $df = 3$, $p < 0.001$
AUDIT score	3,129					$\chi^2 = 371.4$, $df = 6$, $p < 0.001$
Low risk		81.0 *(1.5)*	55.4 *(2.7)*	46.2 *(3.6)*	22.8 *(2.1)*	
Risky/hazardous		18.8 *(1.5)*	41.5 *(2.6)*	49.9 *(3.4)*	56.1 *(2.5)*	
High risk		0.2 *(0.2)*	3.2 *(0.9)*	4.0 *(1.5)*	21.0 *(2.3)*	
Tobacco smoking	3,122					$\chi^2 = 235.7$, $df = 6$, $p < 0.001$
Non-smoker		86.6 *(1.3)*	75.5 *(2.2)*	60.3 *(3.0)*	45.6 *(2.5)*	
Smoked in last 30 days		4.6 *(0.8)*	14.8 *(1.7)*	13.8 *(2.1)*	17.9 *(1.9)*	
Regular (weekly or more)		8.9 *(0.1)*	9.7 *(1.6)*	25.8 *(2.5)*	36.5 *(2.4)*	
Cannabis Use	3,088					$\chi^2 = 167.4$, $df = 3$, $p < 0.001$
No		86.2 *(1.4)*	64.6 *(2.2)*	64.8 *(3.3)*	45.7 *(2.6)*	
Used in past 12 months		13.8 *(1.4)*	35.4 *(2.2)*	35.2 *(3.3)*	54.3 *(2.6)*	
Illicit Drug Use	3,074					$\chi^2 = 87.6$, $df = 3$, $p < 0.001$
No		95.0 *(0.9)*	86.4 *(1.5)*	84.8 *(2.4)*	73.1 *(2.2)*	
Used in past 12 months		5.0 *(0.9)*	13.6 *(1.5)*	15.2 *(2.4)*	26.9 *(2.2)*	

[1] rates are expressed as percentages

Note. Illicit drug use incorporates any use of cocaine, amphetamines, inhalants, sedatives, hallucinogens or opioids in the previous 12 months.

Table S4. Sensitivity Analysis with Inverse Probability Weighting: Socio-demographic characteristics associated with latent class membership

	N	Rates (%, *standard error*) by Class membership				Omnibus Test (Wald)
		Rarely drinks to cope	Confidence	Low Mood	Generalised motives	
Socio-demographic						
Sex	3,135					$\chi^2 = 24.3$, *df* =3, $p < 0.001$
Male		54.9 *(1.8)*	53.7 *(2.6)*	45.1 *(3.4)*	41.8 *(2.6)*	
Female		45.1 *(1.8)*	46.3 *(2.6)*	54.9 *(3.4)*	58.2 *(2.6)*	
Odds Ratio (linear term)		1.0 [ref]	1.05 [0.80–1.38]	1.48 [1.09–2.01]	1.69 [1.31–2.17]	
Housing tenure	3,129					$\chi^2 = 17.1$, *df* =6, $p = 0.009$
Mortgaged/owned home		80.3 *(1.6)*	89.6 *(1.6)*	79.4 *(2.8)*	81.6 *(2.1)*	
Rented		8.3 *(1.1)*	6.3 *(1.2)*	9.2 *(1.9)*	10.1 *(1.6)*	
Subsidized Housing		11.4 *(1.3)*	4.1 *(1.2)*]	11.4 *(2.1)*	8.3 *(1.5)*	
Odds Ratio (linear term)		1.0 [ref]	0.59 [0.45–0.78]	1.02 [0.81–1.30]	0.90 [0.73–1.10]	
Disposable income	2,853					$\chi^2 = 35.5$, *df* =12, $p< 0.001$
High		20.8 *(1.4)*	30.3 *(2.1)*	16.7 *(2.4)*	21.0 *(2.0)*	
Middle High		21.5 *(1.4)*	25.2 *(2.0)*	20.2 *(2.8)*	20.2 *(2.1)*	
Middle		21.5 *(1.5)*	20.8 *(1.8)*	19.3 *(2.5)*	21.8 *(2.1)*	
Middle Low		18.8 *(1.6)*	16.0 *(2.0)*	24.9 *(2.9)*	20.0 *(2.2)*	
Low		17.5 *(1.5)*	7.8 *(1.4)*	18.9 *(2.8)*	17.1 *(2.1)*	
Odds Ratio (linear term)		1.0 [ref]	0.78 [0.71–0.86]	1.10 [0.97–1.24]	1.01 [0.92–1.11]	
Parental social class	2,988					$\chi^2 = 47.2$, *df* =12, $p< 0.001$
I Professional		15.9 *(1.2)*	27.4 *(1.9)*	10.7 *(2.1)*	15.6 *(1.8)*	
II Managerial/Technical		45.1 *(1.8)*	44.1 *(2.2)*	44.4 *(3.0)*	45.3 *(2.5)*	
III Skilled Non-manual		23.6 *(1.5)*	18.2 *(1.8)*	29.3 *(3.0)*	23.8 *(2.2)*	
IV Skilled Manual		9.9 *(1.2)*	8.3 *(1.5)*	11.0 *(2.0)*	11.3 *(1.8)*	
Partly Skilled/Unskilled		5.2 *(0.9)*	2.0 *(0.7)*	4.5 *(1.3)*	4.0 *(1.0)*	
Odds Ratio (linear term)		1.0 [ref]	0.72 [0.62–0.83]	1.09 [0.96–1.25]	0.99 [0.87–1.12]	
Maternal education	3,103					$\chi^2 = 70.4$, *df* =6, $p< 0.001$
Beyond high school		15.1 *(1.2)*	32.0 *(2.4)*	9.6 *(1.7)*	16.4 *(1.8)*	
High School quals		63.2 *(1.7)*	57.2 *(2.4)*	61.1 *(2.9)*	67.0 *(2.3)*	
No high school quals		21.7 *(1.6)*	10.8 *(2.0)*	29.3 *(2.9)*	16.6 *(2.0)*	
Odds Ratio (linear term)		1.0 [ref]	0.45 [0.34–0.58]	1.45 [1.12–1.89]	0.84 [0.68–1.03]	

Table S5. Sensitivity Analysis with Inverse Probability Weighting: Predicting latent class membership using internalising disorders

	N	Odds Ratios for Latent Classes (Reference group: Rarely drinks to cope)			Omnibus Test (Wald)
		Confidence motives	Low Mood motives	Generalised Coping motives	
Internalising disorders					
Depression diagnosis at age 17-18	3,478				$\chi^2 = 46.4$, $df = 2$, $p < 0.001$
No		1.00 ref	1.00 ref	1.00 ref	
Yes		1.46 [0.79 to 2.69]	2.11 [1.06 to 4.19]	6.64 [4.17 to 10.57]	
Anxiety diagnosis at age 17-18	3,002				$\chi^2 = 42.0$, $df = 2$, $p < 0.001$
No		1.00 ref	1.00 ref	1.00 ref	
Yes		1.90 [1.13 to 3.18]	2.26 [1.28 to 3.96]	6.00 [3.88 to 9.22]	